

WHAT IS CLAIMED IS:

- 1 1. An electric rotating machine comprising:
 - 2 a U-phase coil constructed in a manner such that U_n partial coils ($U_1, U_2,$
 - 3 U_3, \dots) which are n ($n \geq 3$) in number are connected in series to each other, with
 - 4 one end of said U-phase coil being connected to an input/output terminal;
 - 5 a V-phase coil constructed in a manner such that V_n partial coils ($V_1, V_2,$
 - 6 V_3, \dots) which are n ($n \geq 3$) in number are connected in series to each other, with
 - 7 one end of said V-phase coil being connected to an input/output terminal;
 - 8 a W-phase coil constructed in a manner such that W_n partial coils ($W_1,$
 - 9 W_2, W_3, \dots) which are n ($n \geq 3$) in number are connected in series to each other,
 - 10 with one end of said W-phase coil being connected to an input/output terminal;
 - 11 a ring-like stator core having a plurality of slot group sets formed in its
 - 12 circumferential directions, each including a U-phase slot group, a V-phase slot
 - 13 group and a W-phase slot group arranged continuously, said U-phase slot group
 - 14 for accommodating said n ($n \geq 3$) U_n partial coils formed in a state adjacent to
 - 15 each other in said circumferential directions, said V-phase slot group for
 - 16 accommodating said n ($n \geq 3$) V_n partial coils formed in a state adjacent to each
 - 17 other in said circumferential directions, and said W-phase slot group for
 - 18 accommodating said n ($n \geq 3$) W_n partial coils formed in a state adjacent to each
 - 19 other in said circumferential directions;
 - 20 a stator winding to which the other ends of said U-phase coil, said V-phase
 - 21 coil and W-phase coil are connected; and
 - 22 a rotor having a plurality of magnetic poles formed along said
 - 23 circumferential directions,
 - 24 wherein each of said U_n partial coils (U_1, U_2, U_3, \dots) includes a circling
 - 25 coil composed of U_n inside-slot conductor portions accommodated in the
 - 26 corresponding U-phase slot group and outside-slot conductor portions for making
 - 27 connections between said U_n inside-slot conductor portions in the exterior of the
 - 28 U-phase slot group, with said circling coil of said U_n partial coil approximately

29 circling said stator core in said circumferential directions, and each of said V_n
 30 partial coils (V_1, V_2, V_3, \dots) includes a circling coil composed of V_n inside-slot
 31 conductor portions accommodated in the corresponding V-phase slot group and
 32 outside-slot conductor portions for making connections between said V_n
 33 inside-slot conductor portions in the exterior of the V-phase slot group, with said
 34 circling coil of said V_n partial coil approximately circling said stator core in said
 35 circumferential directions, and each of said W_n partial coils (W_1, W_2, W_3, \dots)
 36 includes a circling coil composed of W_n inside-slot conductor portions
 37 accommodated in the corresponding W-phase slot group and outside-slot
 38 conductor portions for making connections between said W_n inside-slot conductor
 39 portions in the exterior of the W-phase slot group, with said circling coil of said
 40 W_n partial coil approximately circling said stator core in said circumferential
 41 directions, and said inside-slot conductor portions of each of said partial coils to
 42 be connected to said input/output terminals are accommodated in slots other than
 43 slots existing at end portions of each of said U-phase slot group, said V-phase slot
 44 group and said W-phase slot group in said circumferential directions.

1 2. The machine according to claim 1, wherein, of each of said U_n partial
 2 coils, said V_n partial coils and said W_n partial coils, said inside-slot conductor
 3 portions of a partial coil connected to a neutral point are accommodated in slots
 4 existing at an end portion of each of said U-phase slot group, said V-phase slot
 5 group and said W-phase slot group in said circumferential directions.

1 3. The machine according to claim 1, wherein a slot of each of said slot
 2 groups is made to accommodate a plurality of inside-slot conductor portions of
 3 said inside-slot conductor portions in radial directions of said stator core,
 4 each of said circling coils is composed of a plurality of U-shaped segments,
 5 connected to each other, each having an outside-slot conductor portion of said

6 outside-slot conductor portions and a pair of inside-slot conductor portions of said
7 inside-slot conductor portions,
8 said outside-slot conductor portion includes a U-shaped head portion
9 protruding from one end side of said stator core to continue into one end portions
10 of said pair of inside-slot conductor portions, and a pair of protruding end portions
11 protruding from the other end side of said stator core to continue into the other
12 end portions of said of inside-slot conductor portions and extending generally in
13 said circumferential directions of said stator core, and
14 said pair of inside-slot conductor portions are accommodated in a slot of
15 an in-phase slot group of said slot groups at the same position in said
16 circumferential directions and at different positions in said slot in said radial
17 directions.

1 4. The machine according to claim 2, wherein, in each of said U-phase coil,
2 said V-phase coil and said W-phase coil, said inside-slot conductor portions of a
3 different partial coil are accommodated between said inside-slot conductor
4 portions of said partial coil connected to said neutral point and said inside-slot
5 conductor portions of said partial coil connected to said input/output terminal in
6 each of the single U-phase slot group, the single V-phase slot group and the single
7 W-phase slot group.

1 5. The machine according to claim 1, wherein, in each of said U-phase coil,
2 said V-phase coil and said W-phase coil, said inside-slot conductor portions of
3 said partial coil connected to said input/output terminal are accommodated at a
4 central position in each of the single U-phase slot group, the single V-phase slot
5 group and the single W-phase slot group, and said partial coil connected to a
6 neutral point are accommodated at an end position therein, and said inside-slot
7 conductor portions closer to said partial coil connected to said neutral point are

8 accommodated at positions closer to an end portion of each of the single U-phase
9 slot group, the single V-phase slot group and the single W-phase slot group.

1 6. The machine according to claim 3, wherein said head portions of said
2 U-shaped segments are arranged in said slots of the stator core in said radial
3 directions and are inclined with respect to an axial direction of said stator core so
4 that the degree of the inclination of each of said U-shaped segments increases as
5 said U-shaped segments are positioned more outwardly in said radial directions.

1 7. The machine according to claim 1, wherein said U_n partial coils, said V_n
2 partial coils and said W_n partial coils, extending in said radial directions, are
3 concentrically arranged in parallel with each other.

1 8. An electric rotating machine comprising:
2 a ring-like stator core having a plurality of slot group sets formed in its
3 circumferential directions, each continuously including:
4 a first phase slot group composed of n ($n \geq 3$) first slots formed in a
5 state adjacent to each other in said circumferential directions; and
6 a second phase slot group composed of n ($n \geq 3$) second slots
7 formed in a state adjacent to each other in said circumferential directions;
8 a stator winding including:
9 a first phase coil made by connecting n ($n \geq 3$) first partial coils in
10 series to each other, with one end of said first phase coil being connected to an
11 input/output terminal; and
12 a second phase coil made by connecting n ($n \geq 3$) second partial
13 coils in series to each other, with one end of said second phase coil being
14 connected to an input/output terminal, the other ends of said first phase coil and
15 said second phase coil being connected to each other; and

16 a rotor having a plurality of magnetic poles in its circumferential
17 directions,
18 wherein each of said first partial coils includes a circling coil
19 accommodated in the corresponding first slots and composed of first inside-slot
20 conductor portions and outside-slot conductor portions for making connections
21 between said first inside-slot conductor portions in the exterior of said slot group
22 sets, with said circling coil approximately circling said stator core in said
23 circumferential directions, and each of said second partial coils includes a circling
24 coil accommodated in the corresponding second slots and composed of second
25 inside-slot conductor portions and outside-slot conductor portions for making
26 connections between said second inside-slot conductor portions in the exterior of
27 said slot group sets, with said circling coil approximately circling said stator core
28 in said circumferential directions, and said inside-slot conductor portions of each
29 of said partial coils to be connected to said input/output terminal are
30 accommodated in slots other than slots existing at end portions of each of said
31 first and second phase slot groups in said circumferential directions.

1 9. An electric rotating machine comprising:
2 a stator core including phase slot groups each composed of a plurality of
3 slots and made along its inner circumferential surface in its circumferential
4 directions; and
5 a stator coil including a plurality of phase coils each made by connecting a
6 plurality of segments each composed of inside-slot conductor portions to be
7 accommodated in said slots and outside-slot conductor portions protruding from
8 said slots,
9 wherein each of said phase coils is formed by connecting a plurality of
10 concentric circling coils, each generally circling said stator core along said inner
11 circumferential surface, and said inside-slot conductor portions of said segment
12 constituting, of said plurality of circling coils, said circling coil which has an

13 external leader terminal are accommodated in, of said plurality of slots
14 constituting each of said phase slot groups, said slot which does not adjoin said
15 slot group different in phase, and an insulating member is interposed between said
16 outside-slot portions adjacent to each other in a radial direction of said stator core.

10. The machine according to claim 9, wherein said segment has a U-like configuration and said plurality of outside-slot conductor portions are disposed into a lattice-like configuration to intersect each other in an axial exterior of an axial end portion of said stator core, and the intersections between said
5 outside-slot conductor portions are arranged in n rows in an axial direction from said axial end portion, and said insulating member is placed at the intersection positions going beyond a first row of said n rows.

1 11. The machine according to claim 9, wherein said segment has a U-like
2 configuration and said plurality of outside-slot conductor portions are disposed
3 into a lattice-like configuration to intersect each other in an axial exterior of an
4 axial end portion of said stator core, and the intersections between said
5 outside-slot conductor portions are arranged in n rows in an axial direction from
6 said axial end portion, and said insulating member is interposed at the intersection
7 positions short of an n-th row of said n rows.

1 12. An electric rotating machine comprising:
2 a stator core including a plurality of slots disposed along its inner
3 circumferential surface; and
4 a stator coil including a plurality of concentric circling coils each made in
5 a manner such that a plurality of U-shaped segments each composed of inside-slot
6 conductor portions to be accommodated in said slots and outside-slot conductor
7 portions protruding from said slots are connected to each other along said inner
8 circumferential surface of said stator core to approximately circle said inner
9 circumferential surface thereof,

10 wherein an insulating member is previously interposed between, of said
11 outside-slot conductor portions adjacent to each other in radial directions of said
12 stator core, said outside-slot conductor portions having the relationship in which
13 said outer circumferential side outside-slot conductor portion is disposed in a state
14 inclined in a radial and outward direction and in a circumferential direction of said
15 stator core with respect to an inner circumferential side protruding end portion to
16 suppress sliding contact therebetween when said inner circumferential side
17 outside-slot conductor portion is inclined in said radial and outward direction and
18 in said circumferential direction.